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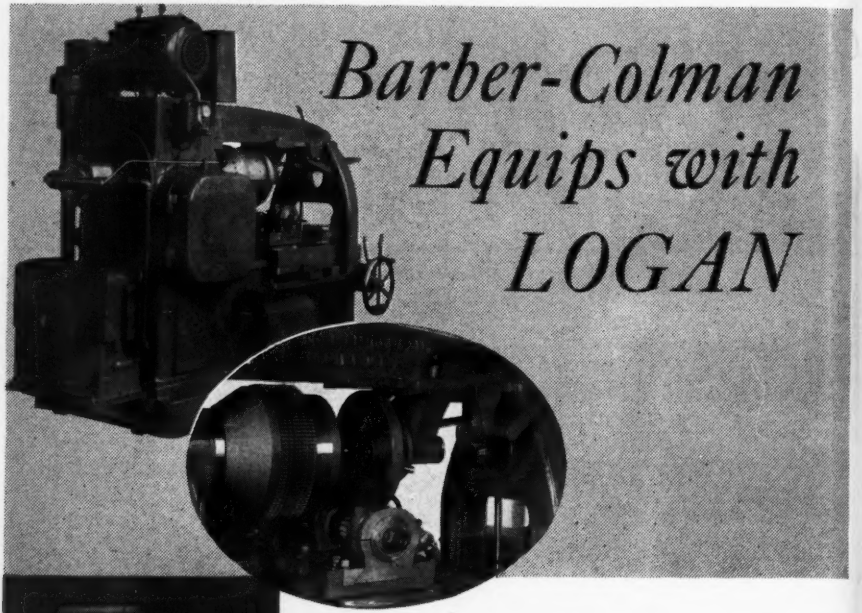

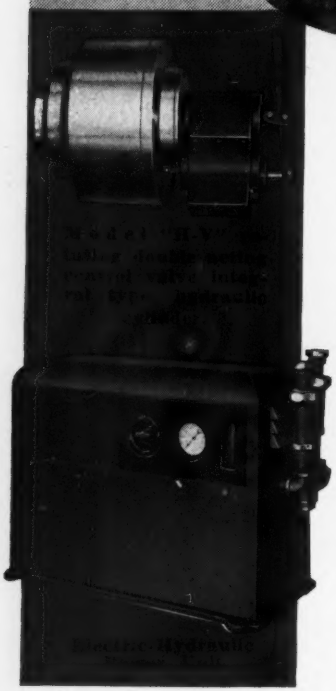

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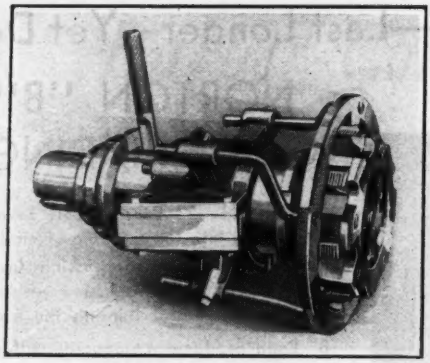

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MODERN Machine Shop

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MODERN Machine Shop

AUGUST, 1932

CINCINNATI, OHIO VOL. 5, NO. 3

Cutting Manufacturing Costs in the Graham-Paige Plant

A few examples of the methods used to reduce costs in the manufacture of automobiles.

By DONALD A. CLARK

THE constant increase in the quality of the modern automobile, with a practically constant reduction in the selling price, constitutes an achievement that has been made possible only through a constant and intense study to develop methods whereby the costs of production may be reduced. In the plant of the Graham-Paige Motors Corporation one of the more interesting jobs comprises a combination of five cylinder machining operations, for which four Barnes multiple drilling machines and a special "dumping" fixture are used, all operated by a single operator.

The machines are set into the conveyor line in their proper sequence so that the cylinder blocks can pass directly from the conveyor into the jig on the first machine, and from the jig on the last machine directly onto the conveyor again. Between the first and last operations the block is moved by a single lever from one fixture to the next, and is automatically clamped and unclamped.

In the first operation in this line the surface around the valve seats is spot faced to a given height, as determined by a dial indicator that is attached to the drilling head. The second machine rough drills the valve throats. The third machine drills the holes for the valve guides, and between this machine and the last one the block is passed to a table where it is automatically turned over and the chips are dumped out. The last machine rough reams the valve guide holes and finish reams the throat.

As the block passes from the conveyor into the jig on the first machine, it passes over a pair of wire brush wheels that are set into the end of the conveyor. One of the brushes is indicated at A in Fig. 1. The brushes are on a spindle that is actuated by a small motor, the switch for which is operated by a foot pedal. When the operator is about to move a block into the first jig, he steps on the switch and as the block moves over the brushes, the brushes remove all dirt from the bottom of the casting and thus provide for accuracy in

locating. The movement of the brushes is opposite to the direction of the cylinder.

Locating and clamping of the cylinder block in the first jig is a manual operation, but in the subsequent operations these tasks are performed automatically. All machines are started on their operation cycle at the same time and as each machine finishes, a dog is tripped and the head rises to starting position again. When the longest operation is finished, the entire line of blocks is moved on, each to the next jig. Again they are located and clamped and the operation is repeated.

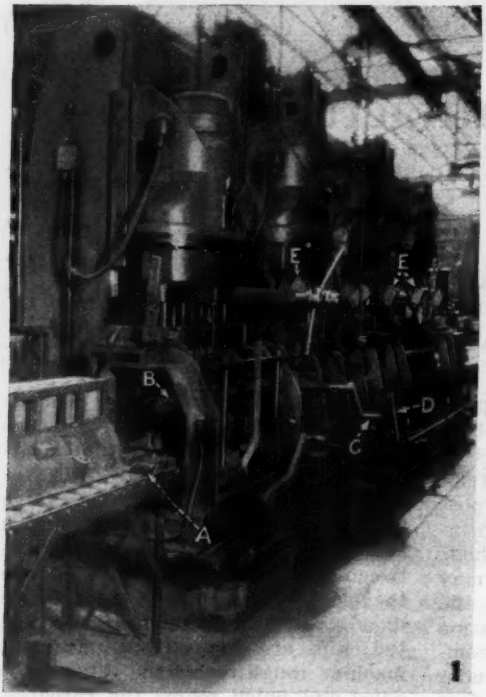


Fig. 1—Automatic loading and automatic operation of machines makes it possible for one man to operate this entire line of machines.

The mechanism by which the blocks are moved to the second, third, and fourth machines consists of a long bar **B** with a rack on the under side, meshing with a gear on the crank handle **C**, Fig. 1. This bar extends through the entire line of jigs, riding in guides in each jig. At the proper places in the bar are located a number of spring-actuated fingers, hinged so that they will close in and slide past obstructions when the bar is moved to the left, but will immediately spring out again and carry the blocks with them when moved to the right.

Therefore, to move the several blocks on to the subsequent operations, the bar is moved as far as possible to the left and then is returned to the right, carrying the blocks. The fingers are located in the bar at the correct intervals so that each block will be carried to the proper position in the jig, and stop-bars inside the jigs serve to locate the blocks crosswise. When the machines are started, the bottom plates of the jigs, upon which the blocks are resting, lower and allow the blocks to settle down upon dowel pins that fit into locating holes in the bottoms of the blocks.

With the blocks in position for the next operations, the operator swings lever **D**, Fig. 1, to the right, thus starting the cycle of operations on the entire line past the first machine. As the machine heads feed downward, weights are released which bring clamps to bear upon the tops of the blocks and thus hold them in position. The weights are indicated at **E**, Fig. 1 and 2. As the heads rise upon the completion of the operations, the weights are raised with them, releasing the clamps and allow-

ing the bottom plates to raise the blocks clear of the locating pins. Again the operator revolves the crank handle **C** to the left, bringing the bar **B** as far as it will come and then reversing the handle, moving the line of blocks onward.

In Fig. 2 is shown the "dumping table" in the line between the third and fourth machines. As the block slides onto this section of the conveyor, it passes under the arches formed by the curved beams **F**, and under the bar **G**. This section of the conveyor is hinged at the rear and counterbalanced, and is also connected to the head of the next drilling machine by the bar **H** in such a way that as the head lowers in the machining operation, the conveyor section or "dumping table" is tipped to the rear, thus throwing out the chips. As the machine head rises again, the cradle is tipped back into place in the conveyor line and the block is ready to be moved to the following operation. Figure 3 shows the last machine in this line, from the opposite end of the line. The possible production on this line is 30 blocks per hour.

Another interesting piece of cylinder machining equipment is the machine shown in Fig. 4. Here the main bearing and cam bearing holes are rough reamed, for which shell spiral reamers are used that slide onto either of two shafts where they are anchored by means of bayonet locks. The necessity for slipping each individual reamer onto its bar by hand, with the attendant loss of time, is eliminated by the use of a cradle in which the reamers are carried when not in use. The cradle is hinged and counterweighted to allow for swinging up out of the way when the block is to be removed.

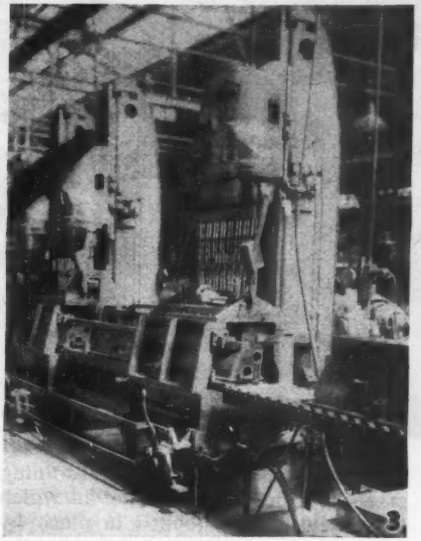
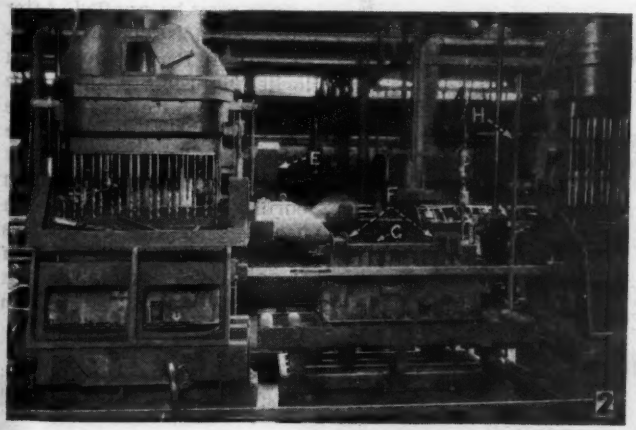


Fig. 3—The line from the opposite end.

Fig. 2—Here the block is turned over and the chips are automatically "dumped."



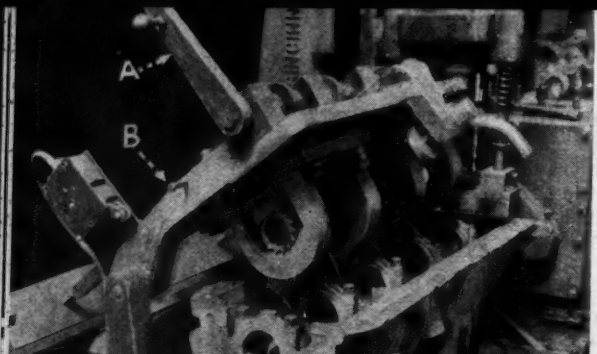
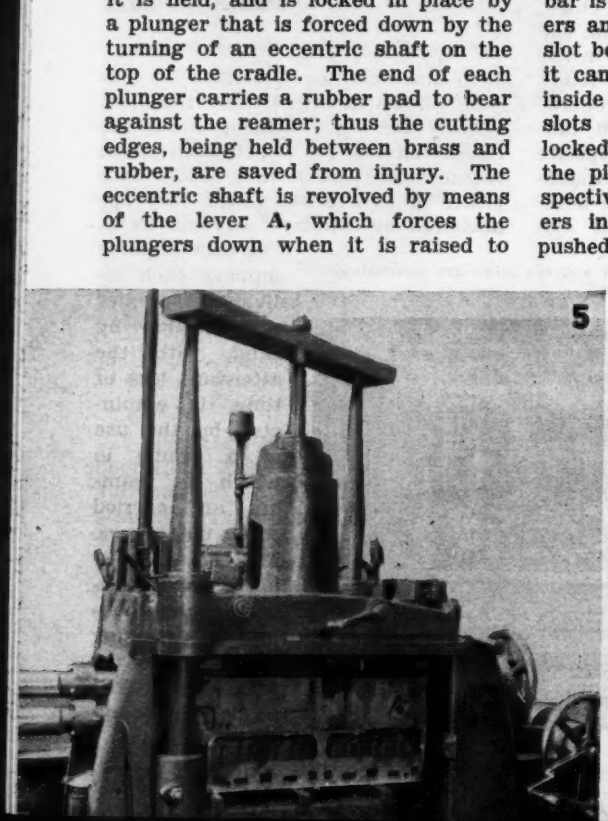


Fig. 4 — This cradle places the reamers on the bar and removes them again automatically.

Each reamer rests on a brass lining in the bottom of the pocket in which it is held, and is locked in place by a plunger that is forced down by the turning of an eccentric shaft on the top of the cradle. The end of each plunger carries a rubber pad to bear against the reamer; thus the cutting edges, being held between brass and rubber, are saved from injury. The eccentric shaft is revolved by means of the lever **A**, which forces the plungers down when it is raised to the vertical as shown in the illustration, and raises the plungers when it is pushed back so that it lies against the bolt **B**. In this position it contacts the lever on the switch box to the rear so that current may be applied; thus it is impossible to apply power while the reamers are still locked.

After a block has been placed in position and clamped, the operator swings the cradle down into place, bringing the reamers into line with the bearings and with the bar. The bar is then pushed through the reamers and through the bearing holes, a slot being provided in the bar so that it can pass the driving pins on the inside of each reamer, with radiating slots into which the pins can be locked. When in the proper position, the pins are engaged with their respective slots, thus locking the reamers in place. The lever **A** is now pushed back against the bolt **B**, releasing the reamers and throwing the safety switch so that power may be applied. After the operation has been completed, the reamers are again locked in their pockets, the bar is withdrawn, and the cradle is lifted, leaving the block free for removal.



The operation of finish boring the main and cam bearings in the cylinder is performed with the aid of the machine shown in Fig. 5. This is a W. F. & John

Fig. 5—Main and cam bearing boring machine, with bars in place and block in position for boring.

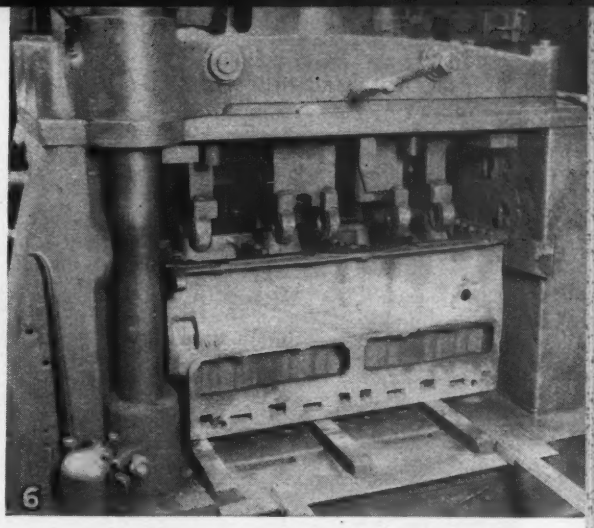


Fig. 6—Block down and bars out, showing guides for boring bars.

Barnes special boring machine, equipped with a hydraulic mechanism for raising the table, carrying the block, into position for the operation. Figure 6 shows the machine with the table down on a level with the conveyor line, which is loading position.

When the block is in position, as shown, the table is raised hydraulically until the top face of the block comes in contact with the rough location pads, at which point the boring bars can be shoved through the rough holes in the block but are enough off center so that the cutting tools will pass through also. This done, the rough location pads are raised by means of a crank, allowing the block to be raised to boring position against solid locating pins. Swinging props under the table are now pushed into place to brace the table, the boring bars are connected with the spindles of the machine, and the operation proceeds. When finished, the props are removed, the rough location pads are forced down until the boring bars are enough off center so that they can be removed without disturbing the tools, and the block is lowered to the loading platform.

The operation described in the preceding paragraph affords a striking example of the advantages that are possible through the use of carbide tools. Before tungsten carbide tools were applied to this operation, it was necessary to regrind the tools after each fifth block. Now that tungsten carbide is being used, approximately 500 blocks are bored before the tools require changing or regrinding.

The camshaft in the Graham motor runs in steel-back babbitt bearings that are machined to size and are then pressed into place in the motor. There are five bearings, all of which are pressed in at the same time by the use of the hydraulically-operated machine shown in Fig. 7. The machine is provided with a horizontal sliding fixture with five carriers, up-

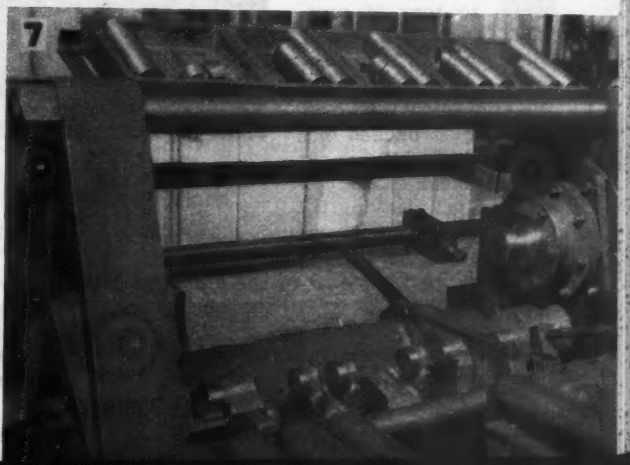


Fig. 7 — This machine presses five cam bearings into place in the cylinder block.

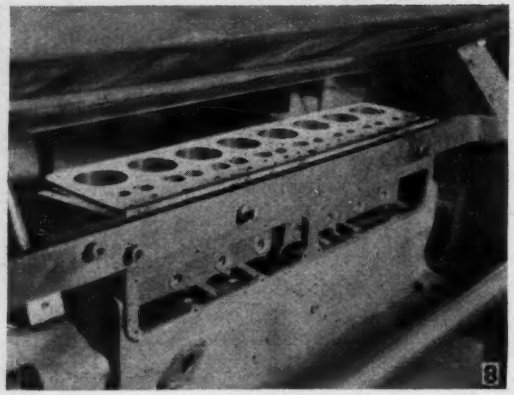


Fig. 8—View of the bearing-assembling machine from the rear, showing block in position and bearings ready to be pressed in.

on each of which a bearing is placed by hand, as shown in the illustration. The cylinder block is then moved into position and the fixture is swung into line with the camshaft holes in the cylinder block. Power is then applied and the hydraulic ram, moving slowly, moves the fixture and presses a bearing into each bearing hole in the block.

The bearings are made 0.004 in. oversize, to provide for a good press fit, and some 10 tons of pressure is required to seat the bearings. When the bearings are in place, the power is reversed, the ram is backed out, and the fixture is swung clear of the cylinder block, leaving the block free to be removed. The entire operation is finished in two minutes. A rear view of the machine is shown in Fig. 8, with a block in position and the bearings in position for pressing in. Although not a cylinder operation, the job illustrated in Fig. 9 is sufficiently interesting to mention. The operation is that of turning brake shoes, and the equipment is a combination of a lathe and a combination air-hydraulic fixture. The fixture holds eight shoes, mounted in pairs. One set of four tools is positioned properly to rough machine a set of shoes, while a second set of four tools, located in the rear of the machine, finishes them. Thus the actual time required for turning is only the time required to turn one shoe.

The shoes are located in the fixture by slipping the holes in each end of each shoe over corresponding pins in the fixture. Each pair of pins is, however, located on an individual fixture consisting of a cylinder in which air from the shop air-line, at a pressure of 90 lb. per sq. in., is built up to a hydraulic pressure of 600 lb. per sq. in. Thus when the air is applied, each shoe is gripped firmly. Tantalum carbide tools are used on this job, operating at a cutting speed of 125 ft. per min. with a 1/16-in. cut. The average production on this operation is approximately 120 shoes per hour.

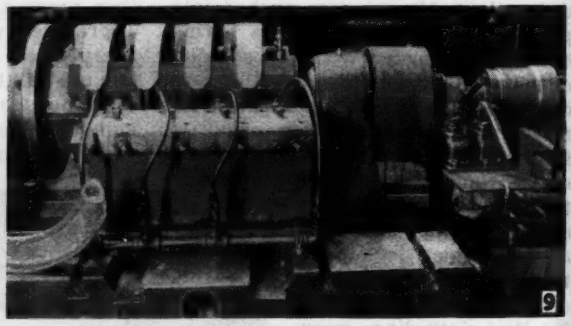


Fig. 9 — With this equipment eight brake shoes are turned simultaneously. Production, 120 shoes per hour.

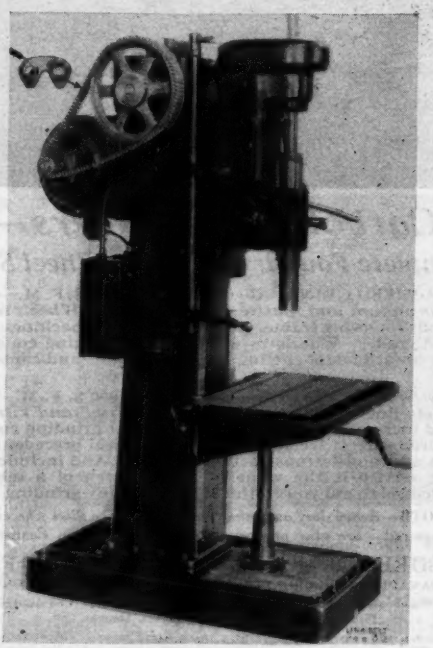
Advantages of Silent Chain for Driving Machine Tools

By RALPH S. DYSON
Special Engineer, Link-Belt Company

IN the modern plant an increasing amount of attention is being paid to details affecting the quantity and quality of production, and while in the past many machine tool manufacturers have designed and built highly efficient machines, their efforts were often discounted by the use of an inefficient medium of transmission between the source of power and the tool.

Considered from all angles, probably one of the most desirable mediums for the transmission of power from electric motor to machine tool is a correct form of chain drive. There is hardly a method that is more flexible in its application, more easily applied, or more efficient, durable, and smooth and economical in operation. The motor may be placed in practically any position at any reasonable distance from the driven shaft, and the chain drive permits full latitude in the selection of motor speed without change in the design of the machine. Changes in speed may easily be made by changing one of the sprockets.

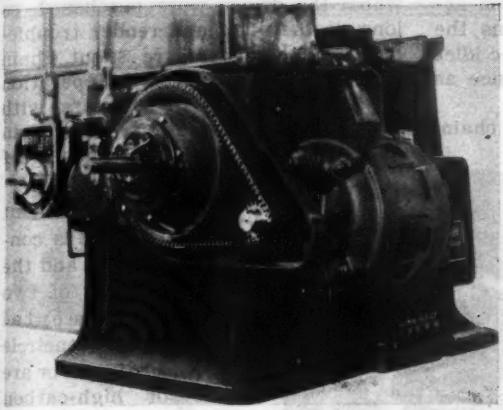
The smooth flow of power to the driven shaft makes possible a greater quantity and better quality of finished work. Cutting tools require changing less frequently, resulting in more productive hours for the machine and considerably less spoilage.



Five H. P. Link-Belt Silent Chain used as medium of power transmission on Barnes Drill, product of Barnes Drill Co., Rockford, Ill.

There is some tendency at the present time toward a motor-in-the-leg design, resulting in a vertical drive to the driven shaft. The best chain drives lend themselves to this layout without affecting the efficiency of the outfit.

The chain drive is now thoroughly established in the field of machine tools, and the manufactur-



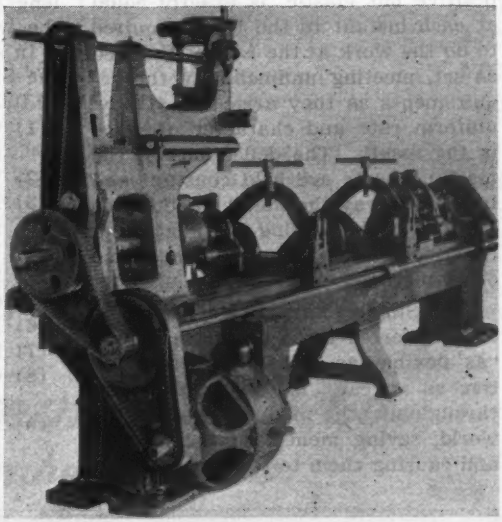
Link-Belt Silent Chain Drive as used on Universal Shaper-Planer, manufactured by Rockford Machine Tool Company.

ers of the silent chain have kept pace with machine tool builders in constantly improving their product and studying its field of application. Many valuable auxiliary drives apart from the main drive have been developed as a result of investigation and laboratory tests.

One of the more important improvements which have been developed to increase the efficiency of the chain drive is the automatic idler, which after being employed in thousands of automatic front end drives was applied to machine tools — and with unqualified success. The automatic idler is used with any type of chain, although the Back or Duplex type of silent chain is more often employed, as its use increases the arc of contact on the wheels and permits the drive to fit into smaller space.

Three general methods are used for mounting the automatic idler to the frame of the machine. For light drives where a large amount of eccentricity of the automatic idler is not required, the simple stud shaft is used. For heavier drives and where the details of the drive require a comparatively large amount of eccentricity of the automatic idler, either a large diameter flanged housing or a simple finished pad is provided for the idler mechanism for bolting to the frame of the machine.

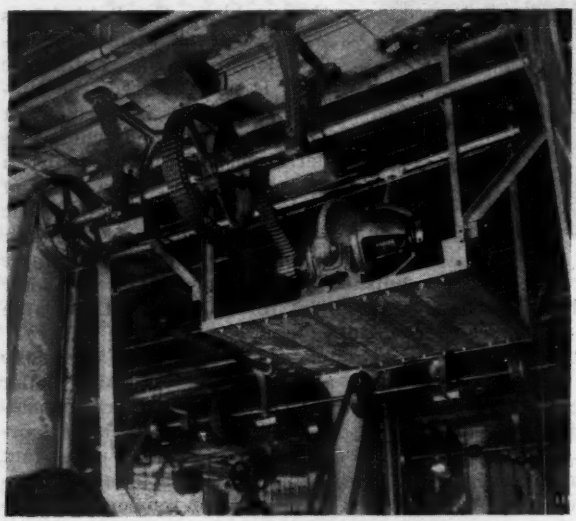
The use of the automatic idler may make a chain drive desirable under conditions that were formerly considered prohibitive, or at least unfavorable for good operation. The fact that the chain is continually maintained at the proper tension, with the resulting ultra-smooth action of the chain over the sprockets, not only in-



Three-way pipe-drilling machine, manufactured by Morris Machine Tool Company, Cincinnati, Ohio, using four Link-Belt Silent Chain Drives. (Casings have been removed to show chains.) The drive operating the upper spindle is equipped with Link-Belt Automatic Idler.

sures a continuous, smooth, even action, but considerably lengthens the life of the drive. The automatic idler also exerts considerable influence as a vibration damper.

The driving force through a chain, positive but elastic, is exactly equal at each instant to the force required to do the work at the rate of the feed as set, meeting unflinchingly the requirements as they arise. A steady, uniform rate and character of work is the result. The deflections in the machine parts are held constant and tools cut away the metal smoothly as opposed to the tearing and chattering that sometimes occur where some other methods of driving are used.



Link-Belt Silent Chain Drive to line shaft in machine shop.

The Silent Chain Drive, which is often referred to as the drive that is "as flexible as a belt and as positive as a gear," is in successful use throughout the industries of the world, saving money for the owners, and causing them to even forget from whom the drives were purchased, so long do they last and render trouble-free service. There are Silent Chain Drives that have been in operation 10, 15, 20 and up to 30 years, with practically no attention other than periodic replenishing of the lubricating oil.

In Link-Belt Silent Chain the wear is confined to the pin and the inside surfaces of two renewable segmental bushings that encircle it. All chain parts are made of high-carbon alloy steel, and the pins and bushings are case-hardened. The pin turns freely; therefore, it wears uniformly and the circular shape is preserved. One pin, two washers, two bushings — that's all. This simple joint protects the links from wear, and helps through its smooth action to prolong the life of both the chain and the wheels.

In synopsis form, the advantages of the Silent Chain Drive may be given as follows:

(1) Can be run at relatively high speeds;
(2) Will run in either direction;
(3) Is not affected by heat, cold or moisture;
(4) Will transmit any amount of power;
(5) Gives a positive velocity ratio;
(6) No limit to ratios;
(7) Ratios are easily changed;
(8) Can be used on short or long centers;
(9) Reduces journal friction to a minimum;

(*Continued on page* 23)

"You Wouldn't Believe It"

The tale of a stock survey and what it disclosed. The name of the plant is fictitious, but — are you sure it couldn't happen in YOUR plant?

By CHAT. SHANNON

THE Hagland Manufacturing Company enjoys an enviable reputation among both customers and employes. From office to drafting room to shipping platform, each one is proud of his job and that pride is reflected in the product. No detail is ever "good enough." The guiding spirit is that of the president, affectionately known among officers and employes as the "Big Boss." His honesty and fairness keep the organization free of shop politics, and his keen sense of humor saves many a difficult situation.

Like all other extremely human persons, however, the Big Boss has his weaknesses, one of which is a distinct aversion to anything that savors of "red tape." And this characteristic is reflected throughout the plant. In consequence, records and control have not kept pace with the growth of the factory, and many details which should be taken care of automatically through adequate records, intelligent control, and consistent ordering, are still entrusted to memory, personal effort, and the judgment of various individuals.

One day the Big Boss sent for one of his engineers. He motioned him to a chair near the desk and thoughtfully gazed out of the window for several minutes, as though looking through the brick walls at the inside of the plant. Suddenly he turned and exploded one of the surprise questions with which he enjoyed checking alertness.

"Gerry, do you use all the various sizes and styles of screws that we stock?"

"No, I don't, Mr. Hagland, but I suppose some of the other designers need the ones I have no use for."

"I wonder," speculated the Big Boss. "Gerry, I want you to find out about them. Things are a little slack just now and it is a good time to make a check-up. Find what sizes and styles we have for which there is little or no use. Go into the matter thoroughly. In other words, I want to standardize our screw stock with a view to cutting down our inventory. For example: we now carry certain sizes in both square and hexagon heads, but we can probably eliminate one head style.

"Other things will suggest themselves as you go along and it will probably be a bigger job than either of us anticipates. Don't hesitate to follow up anything that promises a saving. The amount of time you spend on it is unimportant; results are what will count. I want a complete report on screws of all kinds, with recommendations based on your studies. Bring your report to me when it is completed, but not before."

"Sounds like a pretty big job," Gerry said seriously. "Have you any suggestions about how to begin?"

"Practically none. It's your job, not

mine," the Big Boss smiled as he pushed a folder across the desk. "Here are some pamphlets from the A. S. M. E. and the Government that will be useful to you. They started me thinking about it. Good luck."

About two months later, Gerry deposited a stack of typewritten data and a many-paged report on the Big Boss' desk. The president whistled in surprise.

"It looks as though you had taken my orders seriously," he said, grinning at Gerry.

"Wasn't I supposed to?" Gerry countered. "In what way do you mean?"

"If I remember correctly, I told you to be thorough, but I didn't expect a treatise on screws in general!"

"It just concerns those carried in stock by the Hagland Manufacturing Company," said Gerry, defensively.

"Hmm. How much can we reduce that inventory?"

It was Gerry's turn to grin. "If I told you the figures, you wouldn't believe it!"

"I'll believe almost anything after seeing the size of that report. Twenty per cent?"

"Better read the report, which is based on these data sheets. A little at a time may be believable, but the total is beyond belief."

"It will take a long time to assimilate the report, Gerry. I'm anxious to know the results, so draw up a chair and tell me about it. We might just as well have some fun out of it. I'll look your report over later."

"Well, to begin with," Gerry explained, "we stock four sizes of numbered screws: 8-32, 12-24, 16-20, and 20-16. We also carry ¼ inch, 5/16 inch, and ⅜ inch, which are approximately the same sizes, except for the 8-32. So we can eliminate three sizes. These numbered screws are stocked in both flat and round heads, but both styles can be replaced by the fillister heads we already carry in the fractional sizes and this will reduce the styles fifty-five per cent in three sizes. We can add fifty per cent to our present stock of ¼-inch, 5/16-inch, and ⅜-inch fillister head screws, giving us larger stock orders, and reducing the inventory twenty-seven per cent. It's all here on these sheets."

"Don't bother me with them now. Let's see, fifty-five per cent, fifty per cent and twenty-seven per cent. Where does that land us? Too many percentages for me to figure out! You mean to use low finister heads, of course. The standard height would stick up too far, or counterbore too deep, for sheet metal or thin parts."

"No, there is another saving. The new standard heads are approximately three-quarters of the screw diameter and are well rounded on top so that they replace both the low heads and the former standard heads. This also applies to hexagon and will reduce the styles another fifty per cent up to the ⅞-inch size. By eliminating the square heads in the ¼-inch, 5/16-inch, and ⅜-inch, 7/16-inch, and ½-inch sizes we can make a further reduction in styles and this will effect a reduction in our bar stock inventory."

"But," objected the Big Boss, "how about wrenches rounding the corners of these small hexagon heads?"

"We carry about half of our stock in hardened screws. If we harden all of them, the saving in inventory, records and stock room space will pay for the extra hardening and our products will be better. Anyway, the A. S. M. E. have standardized on hex. heads; they look better and require less steel."

"Hmm. You win, my boy. Go on. What does this style reduction amount to?"

Gerry turned several sheets of his report. "From the 8-32 size to and

including the ⅞-inch size there are thirty-four styles which can be reduced to eighteen styles, or a reduction of forty-seven per cent."

"Whew!" whistled the Big Boss, "forty-seven per cent!"

Gerry grinned and continued, "Now if we consider all sizes up to the 1¼-inch, which is the largest we carry any quantity of, it still means a forty per cent reduction. If we harden all of them, the total reduction in styles will be an even sixty per cent, for we stock both hardened and soft screws in twenty diameters and styles out of the remaining twenty-four from the previous elimination."

"And we will get the benefit of bigger runs on those we do stock," added the Big Boss. "What next?"

"I knew that I never used the 7/16-inch size. I checked up and found that the designers who did had no objection to replacing them with ⅜-inch or ½-inch. The quantities used are small, but it will make the final reduction on cap screw sizes and styles sixty-two and one-tenth per cent!"

"How about the lengths?"

"I went at that differently. I took the 1925 inventory, added the quantities ordered and placed in stock during the year, subtracted the 1926 inventory and so obtained the amount used during the year of 1925. I did this with the other four years and noted whether the use was increasing or decreasing. I made allowances for reduced manufacturing during the last two years and then similar calculations for the seven-year period. These figures show indisputably which items should be discontinued. It also showed some funny things in regard to control."

Gerry turned a few pages of the data sheets. "Now here is a screw that shows a use of 3500 per year and during the past seven years many orders for 100 to 300 have been made. There are other instances. I found that when the screw machines were very busy, they would sometimes put off running a large order until the stock was depleted. Then they asked the order department for a small order which could be wedged in between other jobs. Another way this happens is that stocks are depleted suddenly by several assembly departments taking out more than they need at the time and placing the extra ones in a box under a bench. Then an emergency order is run through. These small orders are expensive, as the cost figures below each one show. With the average yearly consumption known, the condition can be eliminated.

"Here is another peculiar case. There hasn't been an order for this size of screw since 1925, but the inventory is increasing each year. There are other cases which show a sudden increase in inventory over the quantities ordered. It was difficult to find out where these excess stocks came from, but there are several sources. One of them is the periodic return of surplus from the assembly floors; for a stock order may have been placed previous to the return and be in process. Another is caused by running quantities in excess of the order. I found one case where 1,000 pieces were run on an order for 100 and, after six years, 860 are still in stock.

"Sometimes a mistake in set-up occurs and the wrong size is made. Sometimes a foreman has need for a few odd-sized screws; he orders them verbally and a large quantity is run off to take care of possible future needs, but really to remain unused in the stock room for many years. Of course, these are side issues, but they exist and the standardization work has brought them to light. They point the way to big savings through better control and ordering."

"Gerry, do you mean to tell me

FELLOWS ANNOUNCES...

A New and Complete Gear Measuring Machine

For accurately inspecting tooth shape, spacing, diameter, eccentricity; and lead of helical gears, guides, etc.

HERE is a new Gear Measuring Machine which incorporates many new and unusual features in design and construction. It is simple in construction, easy to operate, and does not require a high degree of skill on the part of the operator. Yet it is capable of duplicating measurements to one-ten thousandth of an inch and less.

It has been designed for everyday shop use—and is not a delicate "laboratory" product. A feature of noteworthy interest is the ease and rapidity with which it can be adapted from one operation to another. It provides another measure of control over the production of accurate gears. Ask to have our representative in your locality call and explain its many advantages. Write:

THE FELLOWS GEAR SHAPER COMPANY

78 River Street, Springfield, Vermont
616 Fisher Building, Detroit, Michigan

Fellows Gear Measuring Machine set up for inspecting tooth shape of a Helical Transmission Gear.

FELLOWS
GEAR SHAPERS

that all this has been going on in our well managed plant?"

"I told you that you wouldn't believe it, but it certainly is going on, Mr. Hagland. These figures indicate that about $6,200.00 is tied up in stagnant or little used stock. They show excessive costs on small quantity orders. They show the need for elimination of certain items and standardization on those more generally used. Also the need for better stock records and more intelligent ordering."

"Hmm. More red tape, but I guess it may be necessary. What percentage can we save on screw lengths?"

"Not so much, but it amounts to about twenty-one per cent out of the remaining styles and diameters. The total reduction from the present stock is sixty-eight and three-tenths per cent. This means the reduction in items. The quantities required of the remaining thirty-one and seven-tenths per cent will have to be increased an average of one hundred per cent, and that will still permit a reduction in quantity of thirty-six and seven-tenths per cent; all of it active stock that can be run in large quantities determined by estimated yearly needs."

"You've only talked of cap screws. What about the others?"

"We now stock five styles of set screw points, but these can be reduced to two; dog points and cup points will meet all requirements. There are four styles of heads; hollow hex., slotted, low square and square. The hollow hex. and the new three-quarter height standard square heads will do for everything, eliminating two styles. Many sizes and lengths are seldom used. The total reduction is forty-eight per cent in styles and sizes, or thirty-one and one-tenth per cent in quantity.

"Studs show similar conditions, in that many of the sizes are seldom used. Some showed no use since 1925, and I found they had been in stock for fifteen to eighteen years.

"Shoulder bolts can be eliminated entirely. We now have these in stock in graduated sizes. Their use has declined steadily since about 1920, as they are not used on our more modern machines. In those places where they are still used, studs, or cap screws and lock nuts can be substituted.

"The total reduction is fifty-one and six-tenths per cent in items and thirty-four and four-tenths per cent in quantities. I hope you're not disappointed," Gerry grinned at his superior.

The Big Boss grinned back, though a bit ruefully. "Yes, Gerry, I think I am disappointed. I entertained a secret hope that it would not amount to much."

He thought a while in silence. Then he exploded one of his sudden questions.

"Suppose you go back on the drawing board and need a non-standard screw for a certain place?"

Gerry's answer was instantaneous. "I'd change the design, now that I understand the situation."

"What shall we do with the excess stock we have no use for?"

"I have arranged for a jobbing house to take most of it off our hands at a little less than it cost us."

"You've won yourself a new job, Gerry," said the Big Boss, as he pressed a button on his desk.

A moment later the Big Boss' secretary appeared in the doorway.

"Take a memorandum," he said, tersely. "To all Factory Department Heads and Foremen: Mr. Gerald Taylor has been appointed Standardization Engineer and will have complete charge of this work. Preliminary studies have shown a real need for such a position on our staff. Please co-operate with him in every way."

(Continued on page 47)

How would You mill this Groove?

In actual production Scintilla Magneto Company found that a standard Gorton Pantograph Profiler did the job more profitably than any special machine which they could have designed themselves . . .

Name of part: Magneto Cover.
Operation: Milling Felt groove.
Material: Aluminum (Permanent mould casting).
Stock removed: 5/64" square groove 4" long.
Cutter: Special 5/64" dia. single lip.
Cutter R.P.M.: 9000.
Finish: Smooth and clean—no burrs.
Limits: All dimensions plus or minus .001".
Production per hour: 40 pieces.
Machine: Standard GORTON 3-X with simple work-holding fixture and steel master template.

A steel template guides the pantograph reducing mechanism which controls the cutter path. *This template is four times oversize and reduces any error by this proportion.*

This aluminum magneto cover requires machining the 5/64" square groove indicated above. The groove must be located accurately and held to close dimensions.

How would YOU do this job?

Scintilla found the Gorton way most effective. With a simple work-holder and a steel master template (both made in a few hours) they were able to put the job on a *standard* Gorton Profiler and get production at the rate of 40 per hour. An excellent example of the possibilities of pantograph profiling.

Scintilla machines several other types and sizes of magneto covers on this same profiler. Setup for each job takes only a few minutes. Unskilled operators can handle after job is set up.

Perhaps one of your jobs belongs on a Gorton Profiler. To find out, send us blue prints or samples. If your job belongs on a Gorton Profiler, our engineers will submit a layout and schedule of operating methods and advantages.

George Gorton Machine Co.
1101 13th St., Racine, Wis.

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RACINE, WIS., U.S.A.

GORTON
High-Speed PROFILERS

Illuminated Accident Record Bulletin at N. & W. Shops

THE traditional safety and danger signals—green and red—are used at the Norfolk & Western Railway shops at Portsmouth, Ohio, to indicate the safety record of each of the major departments. The names of the departments—erecting, machine, boiler, smith, pipe, and tin, and electrical power—are listed down one side of the bulletin board as shown in the illustration. To the right of the list are five vertical rows of lights, the first of which is green and the others red. These rows of lights tell the lost-time accident story.

Over the first row is a zero. As long as each department continues without a lost-time accident, the green light continues to announce this fact. But when a lost-time accident occurs in any department, the green light opposite the name of that department is switched off and a red light in the No. 1 row tells the story. There are four rows of red lights, as it is rare for more than four lost-time accidents to occur in any one department within a month's time. And in such a case something more serious than the lighting of a red light takes place.

It might not be difficult for the shop force to become so accustomed to passing a bulletin board that it

would lose its effect, but it is practically impossible for most men to pass a red light among a lot of green ones without glancing at it. And no intelligent workman likes to see his department discredited, even though he may have had nothing to do with the error.

Error is the proper word. An accident *is* an error. No high-grade company requires its men to take chances these days; in fact, the taking of chances is discouraged as wasteful and when an accident *does* occur, usually some one has disobeyed orders. The orders may have required the use of goggles when grinding on the emery wheel, or prohibited the use of chisels with "mushroom" heads, or stipulated that no gloves should be worn when operating machines, or that nothing weighing more than a given amount should be lifted without the aid of the crane—but if a man is injured as a result of ignoring these orders, he is directly to blame.

The illuminated accident record compels attention, and undoubtedly forces the matter of safety upon the shop organization at least twice a day.

Advantages of Chain Drive

(Continued from page 14)

(10) Easy to remove or replace chain;

(11) Maintains perfect action even after long use;

(12) 98.2 per cent drive efficiency by actual test.

In a plant in Chicago, in which belt drives were formerly used from motors to line shafts in its machine shops, the punch press operators frequently complained that they were unable to make the production rate set for them. The plant engineer ultimately was asked to make a careful study of the operation of a battery of 15 presses. He soon discovered that the line shaft was running at a speed considerably lower than it should, and that the punch presses were operated at from 7 to 10 per cent below their normal or figured speed. A number of attempts to improve the belt adjustment met with little success. The decreased production must have involved a considerable loss to the company, and to the workers as well, since they were employed on a piece-rate basis.

The plant engineer, having seen a silent chain drive operated successfully under similar conditions, recommended the use of such a drive to the punch press line shaft. Following its installation, complaints from the workers ceased, and production was soon back to normal. This plant later extended the use of silent chain to other line shaft drives, and to a number of individual machines, where positive drives are needed to synchronize production operations.

Tenth Annual Exposition of Power and Mechanical Engineering

In confirmation of the reports that business is showing an improvement, which have come from many firms, there comes the announcement that 293 manufacturers of power-producing machinery, mechanical devices for power transmission, precision instruments for the control of combustion, pressure, volume, flow, and other measurable entities, material handling equipment, and so on, will stage exhibits in the forthcoming Tenth National Exposition of Power and Mechanical Engineering at the Grand Central Palace during the week from Dec. 5th to 10th, which is coincident with the annual meeting of the American Society of Mechanical Engineers. During the past two years—the interval since the ninth exposition—a very considerable amount of research work has been done and the results of this work will be shown at the exposition.

IDEAS FROM READERS

This department is a clearing house for ideas . . . If there is a "kink" or short cut in use in your shop, send in a description of it . . . We will pay $5 for each one published.

Worn Watch Lathe Collet Makes Useful Hand Tool

By CHAS. H. WILLEY

IN DUE course of time the collets used in the small watchmakers' lathes become worn or so badly "out of true" as to be unreliable for use

Drawing of Hand Chuck.

on watch work, and then they are thrown aside. These worn collets can be used to good advantage in hand holders, designed as shown in the illustration. The holder consists, when assembled, of three pieces; the chuck **A**, in the end of which the collet **B** is held, and the draw-bar **C**, with which the collet is drawn into the chuck.

The chuck **A** is made from a piece of round bar stock, bored in one end to a sliding fit for the collet, and counterbored from the opposite end to provide room for the draw-bar. The collet end is tapered so that the jaws of the collet will be closed when the collet is drawn in, the action being the same as that of the ordinary collet chuck.

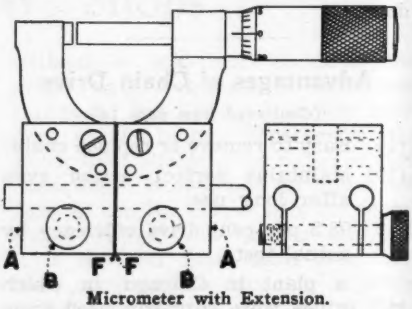
The draw-bar consists of three pieces: A section of tubing (1) threaded in one end to receive the thread on the collet, a knurled collar (2) by which the tube is revolved to screw it onto the collet and a pin (3) that holds the tube and collar together. By holding the chuck **A** in one hand and revolving the piece **C** with the other, the collet is drawn into the chuck.

Such a chuck is extremely useful for holding small work for fitting, grinding, lapping and so on.

Extension for Micrometer

By ARTHUR H. SANDELL

THE drawing shows how an extension was applied to a one-inch micrometer, making it possible to use the micrometer on work up to 24 inches in diameter. The extension consists of two steel blocks that are attached to the two halves of the micrometer frame after the fame has been cut into two pieces, and two rods



Micrometer with Extension.

upon which the blocks slide, so as to obtain the required space between the spindle and the anvil.

The block of steel **A-A** was machined all over, the screw holes for the screws **B-B** were drilled and tap-

ped, the radial slot was milled to fit the micrometer frame, and two holes were drilled through the block longitudinally for the two sections of ¼-in. drill rod. Then the block was sawed into two pieces, after which the pieces were clamped together again in the same relationship they occupied before cutting. The blocks were then slotted from the bottom into the rod holes so that the screws could be tightened to bind on the rods and thus clamp the rods in place.

With the blocks still clamped together and the rods in place, the blocks were clamped to the micrometer frame and the screw and dowel holes were drilled and tapped for anchoring the blocks to the frame. The blocks were then removed and the frame was cut in half, after which the blocks were replaced on the halves of the frame and the screws and dowels were driven home.

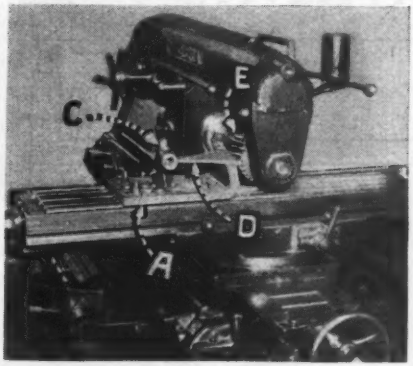
When the blocks **A-A** are locked together with the surfaces **F-F** in contact, the micrometer is a standard one-inch micrometer. For all dimensions up to 24 inches, the micrometer is set by the use of standard measuring rods of the Starret or Brown & Sharpe variety.

Hobbing Teeth in Locomotive Throttle Lever Quadrants

By H. H. HENSON

THE cost of producing teeth in throttle and reverse lever quadrants has been greatly reduced, in a western railway shop, by the use of the set-up shown in the illustration. The equipment consists of a milling machine fixture **A** upon which the work **D** is located and held, and hob **E** with which the teeth are generated. The quadrant is actually located on the stud **C**, which makes it possible to revolve the quadrant upon its axis so that the periphery of the entire tooth-section can be presented to the hob. A spur gear hob is used, usually 12 or 14 pitch.

It will be noticed that the portion of the quadrant upon which the teeth are to be cut is well supported by the vertical leg of the fixture. The fixture is tilted to the same angle as the helix angle of the hob, so that the teeth will be at a perfect 45-degree angle with the sides of the quadrant, and in alignment with the axis.



With this equipment, the teeth in a throttle lever quadrant can be hobbed in five minutes.

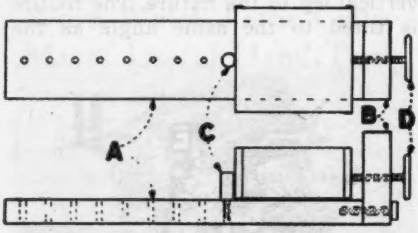
When ready to begin the operation, the milling machine table is advanced until the cutter spots the work. The micrometer thimble on leadscrew is then set and used as a guide in feeding the table in until the cutter is at the required depth. The cutting action of the hob revolves or feeds the quadrant around, finishing the teeth at one pass of the work. The operation ordinarily takes five minutes.

The base of the fixture is provided with several holes to permit changing the position of the stud **C** so that quadrants' various sizes can be accommodated.

Universal Box-Welding Jig

By CHARLES R. WHITEHOUSE

THE drawing shows the design of a jig that was made to hold metal boxes, in process of fabrication, while the corners of the boxes are being welded. The jig consists of a base **A**,



Universal Jig for Welding Metal Boxes.

end plate **B**, stop-pin **C**, and a square thread screw to which is attached the handwheel **D**.

The base of the jig is of 1-in. material, 3 in. wide. The length can be made to suit the job. The end plate is of the same width and thickness as the base, and is attached to the base by means of bolts. The stop-pin **C** is of ½-in. stock, turned down to ¼ in. for 1 in. of its length to fit into corresponding holes in the base. One of these holes is drilled in the base at a point from the end slightly greater than the length of the shortest box to be welded, and this is followed by a series of holes 1 in. apart, to take care of other sizes of boxes.

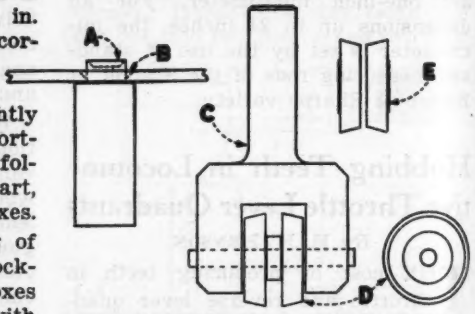
The jig is used in the welding of switch boxes, conduit boxes, knockout boxes, tool boxes and other boxes that are made of sheet metal with folded corners. It is the extreme of simplicity, as it is only necessary for the welding operator to set the stop-pin into the base in the hole that is nearest to the box length, insert the box and tighten the handwheel. The corners are automatically drawn in tightly for a perfect weld.

Rolling Tool "Pinch-Hits" for Riveter

By F. J. WILHELM

WHEN a riveting job is to be done and there is no riveting machine available, an entirely satisfactory job can be done by using a rolling tool such as that shown in the illustration, providing the rivets are of copper, brass or other soft material. It is also necessary that the ends of the rivets be countersunk as shown at **A** so that they can be flanged properly, and the best job is obtained if the material is countersunk as shown at **B**. As the tool is intended for use in a drill press, it is provided with a straight shank as indicated at **C**.

The end of the rivet is rolled down or "headed" by two rollers, **D**, held in the body of the tool by a pin that serves as the axis upon which the rollers revolve. The rolls can be made flat, but best results will be obtained if they are designed to roll concave, as shown at **D**, or convex as shown



Tool for Rolling Brass or Copper Rivets.

at **E**. Either type will produce a satisfactory head.

The rolls are made from a good grade of steel, and the rolls and pin are hardened. The distance between the rolls may be varied to suit the size of rivet used by varying the

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The worth of your machines is measured by their performance—the kind of work they do—the way they stand up—the cost of maintaining them. Put PRECISION Bearings in them, and you'll add a very substantial extra-dependability that will go far toward assuring that "better" service which makes for lower costs and larger profits.

Summed up, PRECISION—in NORMA-HOFFMANN Bearings—means longer life, less liability to shut-down losses, lowest cost per bearing per year of service. This is a fact attested by actual records in hardest service over a long period of years. It is good business, as well as good engineering, to use PRECISION Bearings.

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thickness of the spacing washer, spacing washers also being used outside the rolls to maintain the spacing. Each roll should have an 0.008-in. hub on each side to reduce side friction.

To use, the tool is held in the chuck in a drill-press spindle and the work is held in a machine vise or fixture. The spindle of the machine is operated at high speed, while pressure is applied to the tool by means of the operating lever of the machine. The writer has found this method as fast as the usual riveting machine, the job is just as tight, and the appearance of the head is superior to that of a head produced by hammering.

Slotting a Shift Lever

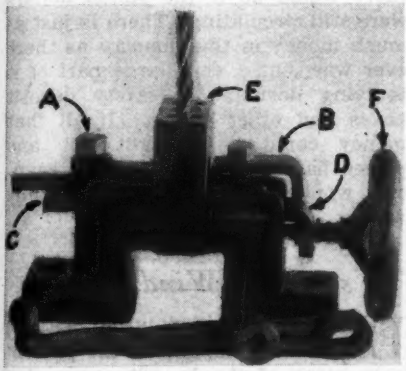
By AVERY E. GRANVILLE

IN THE foreground in the illustration is shown a shift lever in which are two holes. One hole is drilled and faced, and the other is a slot that is finished from a cored hole. As the slot works over a fixed pin, and as this end of the lever does not contact anything but the pin, only the slot is finished.

The piece is awkward to hold, so the special fixture shown was made for the slotting job. The round hole is first drilled and faced, and then the lever is located in the fixture by placing it down over a slide where it is held by a capscrew **A**, through the round hole. The cored end is held by the clamp **B**. The slide, one end of which can be seen sticking out at **C**, is attached to a feed screw by the bent piece **D**, which fits between the collars on the screw at one end and is bolted to the slide at the other.

The slot is milled with a high-

speed steel drill, the outer edges of the flutes of which have been ground with clearance enough so that the drill can be used as a spiral milling cutter. The cutter is operated through the bushed block **E**, which is bolted



Fixture for Slotting a Shift Lever.

to the base in such a way as to bridge the slide and allow the slide and work to be moved freely back and forth under it, which is done by turning the handwheel **F**.

In use, the base of the fixture is bolted to the table of a drill press, with the cutter in the drill press spindle. Stops, which are not visible in the illustration, limit the slide movement to the length of the slot. The fixture is practically fool-proof.

Diamond Flexible Coupling Catalog No. 11

The uses, advantages and features of construction of the Diamond flexible coupling are outlined in Catalog No. 11, which has been issued by the Diamond Chain & Mfg. Co., Indianapolis, Ind. The book also contains tables of dimensions, weights, horsepower transmitted and other specifications for the different types and sizes. Data is included on the selection and installation of these couplings. Various types of drives are shown, with loads up to 700 horsepower. Copies free upon request.

Over the Editor's Desk

Still Hoarding?

THE firms of Dun and Bradstreet undoubtedly know more about the financial condition of the individual business firms of this country than anyone else, therefore any statement by the executives of these firms is bound to be of interest. Accordingly, we quote here a statement by E. B. Moran, Executive Sales Manager of the Bradstreet Company.

Says Mr. Moran, "More advertising scientifically prepared and intelligently placed, backed by more intensive sales effort, combined with confidence in America's business and courage to uphold quality, will succeed on a more permanent basis than business sought on the shifting sands of price competition.

"It is Bradstreet's opinion that there is still $1,000,000,000 hoarded, which has been withdrawn from industrial operations and circulation. There are more dollars out of work by a hundred to one than there are unemployed hands. If, as a result of a concentrated effort of business leaders, fifty per cent of the hoarded money were put back into circulation, I claim that seventy-five per cent of the unemployed hands would be back at work within the next thirty days."

The total amount of business transacted in the United States in normal times amounts to between eighty and ninety billions of dollars per year, and this amount of business is handled with approximately five billions of dollars. Thus each dollar brings home the bacon approximately seventeen times. Each time a dollar is dropped in a sock or placed in a safety deposit vault, it leaves a vacuum that is multiplied by seventeen.

That hoarded billion dollars means that there is seventeen billions of dollars less of business activity than there would be if the billion dollars were still circulating. There is just as much money in this country as there ever was, but a very large part of it is lying dormant in safety deposit boxes and other places. If all that money could be brought out and placed back in circulation, this country would be healthy and happy again.

"It's An Ill Wind——"

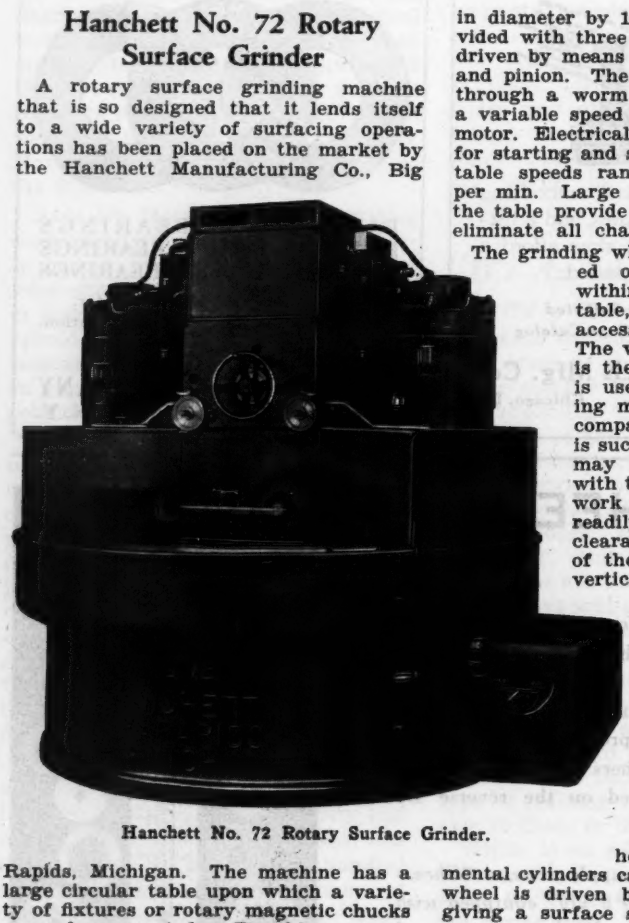
EVEN a depression is not without some benefits, and in the present case some of the benefits are going to the smaller industries of the country, according to a statement by the president of the Massachusetts Institute of Technology. He says, "Our first-class electrical engineering graduates have always tended to go either to Westinghouse, General Electric, or A. T. & T. But this year these companies are not going to take our men, so our boys will go to places that are smaller and less highly organized. Formerly, most of these places wouldn't be even third choice for crack men. Well, it won't do the men any harm and it will do these second or third choice industries a lot of good. They will get a higher type of training than has been available to them in the past."

Which is an additional reason why the smaller industries are going to come back quicker and better than the larger ones. To the advantage of wieldiness will be added a grade of engineering intelligence which should make it possible for the smaller firm to compete on a more equal basis with the larger and older competitor.

NEW SHOP EQUIPMENT

Hanchett No. 72 Rotary Surface Grinder

A rotary surface grinding machine that is so designed that it lends itself to a wide variety of surfacing operations has been placed on the market by the Hanchett Manufacturing Co., Big Rapids, Michigan. The machine has a large circular table upon which a variety of fixtures or rotary magnetic chucks may be mounted. Roughing, semi-finishing, and finishing cuts may be taken without removing the work from the fixture; thus high production is obtained, together with close accuracy and fine finish.



Hanchett No. 72 Rotary Surface Grinder.

The table is of the ring type, 72 in. in diameter by 16 in. wide, and is provided with three circular T-slots. It is driven by means of a large helical gear and pinion. The pinion shaft is driven through a worm gear and worm from a variable speed drive unit and 3 h. p. motor. Electrical push buttons are used for starting and stopping the table. The table speeds range from ¾ to 3 rev. per min. Large V-ways directly under the table provide a rigid mounting and eliminate all chatter or vibration.

The grinding wheel heads are mounted on a central column within the ring type work table, making the machine accessible from all sides. The wheel head adjustment is the patented design that is used on the other grinding machines made by this company. The adjustment is such that the wheel heads may be aligned parallel with the plane in which the work table travels, and can readily be set to provide clearance on the back edges of the grinding wheels. A vertical feed of 6 in. is available for each head, and there is 10 in. of height under each new grinding wheel.

The grinding wheels are 18 in. in dia. by 3 in. high. Various widths of face can be supplied, and either Hanchett Red Anchor cylinder wheels, held in chucks, or segmental cylinders can be furnished. Each wheel is driven by a 15 h. p. motor, giving a surface speed of 5,400 surface feet per minute.

The vertical feed of the grinding wheel heads is automatic, each head feeding down an amount equal to the wear of the wheel and thus providing for close accuracy. If desired, the automatic feed may be omitted and the

machine supplied with the usual type of manual control, including a sight indicator for each head.

Lubrication of the grinding wheel spindle is obtained by pumping oil from a supply tank in the bed of the machine to a reservoir at the extreme top of the machine, from whence the oil drains to the top spindle bearings, thence through a sight gage to the bottom bearing and back to the main tank. A Percolator keeps the oil clean. Oil-wells in the V-ways lubricate the table bearings, and an Alemite system is provided for all other bearings.

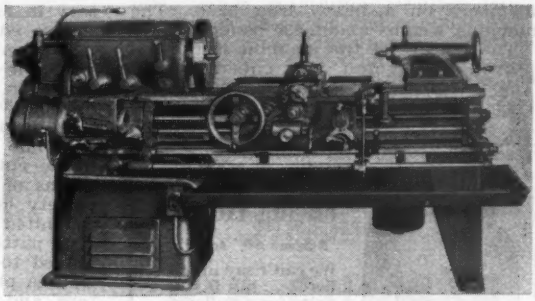
A wheel dresser is provided for each grinding wheel head, arranged so that it can be set to dress the wheels exactly parallel with the plane of rotation. The dresser heads are mounted in ball bearings, and can be fitted with either serrated steel discs or an abrasive wheel. The weight of the machine, without fixtures, is 22,000 pounds.

Reed-Prentice Sliding Gear Head Toolroom Lathe

The illustration shows the latest type of Reed-Prentice Sliding Gear Head Toolroom Lathe, which is now available in 14, 16, 18, and 20-in. sizes, and with either eight or sixteen speeds. Incorporated in the design are such new features as a new quick change gear box with leadscrew reverse mechanism, and anti-friction end works. The quick change gear box provides 49 thread changes from 1½ to 96, and 49 feed changes from 0.0035 to 0.224 in. An auxiliary quadrant also provides for additional gears for odd or metric threads and feeds.

The leadscrew reverse mechanism provides for reversing the carriage when feeding or threading without reversing the direction of the rotation of the spindle. The reverse lever is conveniently located at the right hand side of the apron and adjustable stops provide for automatically stopping the carriage when either feeding or threading in either direction at any predetermined point. The leadscrew nut remains engaged when stopping leadscrew and reversing, permitting ready catching of odd leads and metric pitches. A thread dial provides for catching leads of long screws when the carriage is run back by hand.

The entire end gear train and quick change gear mechanism are mounted in anti-friction bearings. The quick change

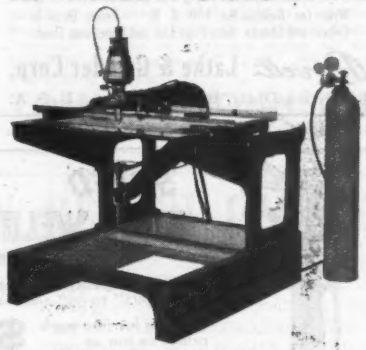


Reed-Prentice Sliding Gear Head Toolroom Lathe.

mechanism is oiled from a central reservoir. An oilpan with rolled edge and cabinet leg for the tailstock can be supplied when required.

Vulcan Gas-Cutting Machine

The gas cutting machine shown in the illustration, a product of Vulcan Engineering Corporation, Jackson, Michigan, represents a distinct advance in the design and construction of equipment for the rapid and economical cutting of mild and low carbon steels by means of oxygen, employing either natural or manufactured gas as the preheating agent. The machine shown is the standard size, having a working surface of 24 x 36 in., and capable of



Vulcan Gas-Cutting Machine.

cutting material from ¼ in. to 8 in. in thickness. An unusual degree of accuracy is possible with this machine, due to the substantial construction. The tracing table and bridge assembly carrying the tracer unit and cutting torch are mounted on cast iron side members on a heavy iron base. The machine weighs about 900 pounds.

The feature of the machine is the improved tracer unit and cutting torch. The tracer unit, which is driven by a 1/30 h.p. motor that operates from the lighting circuit, is quickly adjustable for six speeds and for various thicknesses of stock. The torch connects directly to the city gas line and in operation makes a smooth cut with a narrow kerf. The cut does not have the rounded edges usually considered necessary in flame cutting, but has a sharp square edge.

The versatility of the machine is remarkable and it is said that, in regular operation, at various times it has performed work that previously had been done by milling, shaping, sawing and so on. The machine is easy to operate. Circle cutting is entirely automatic, by means of a graduated radius bar. The variety of patterns that can be cut is unlimited; all that is needed is a full-size pattern or drawing that can be affixed to the tracing table. The stock is then placed directly beneath the pattern, and is cut to identical form as the operator follows the lines of the pattern with the tracer unit. The machine comes complete, ready to operate.

Fellows Gear Measuring Machine

The Fellows Gear Shaper Company, 78 River St., Springfield, Vt., has placed on the market a gear measuring machine in the design of which many unusual features are incorporated. The machine is simple in design and easy to operate, making unnecessary the use of a skilled operator, yet it is capable of checking gears to extremely close limits of accuracy. As will be seen in Fig. 1, it comprises a substantial pedestal upon which is mounted a rotatable table. The work is held on a vertical work-arbor, and the fixture carrying the measuring instruments is located on the top of the table.

The various elements of a gear tooth that can be checked on this machine are: involute profile or shape, circular pitch, pitch diameter and eccentricity, also the lead or corresponding helix angles of

Fig. 1—Fellows Gear Measuring Machine.

helical gears, guides, and other helically-splined members.

The column that carries the work can be adjusted to any desired height through gearing, and the vertical position of the column, particularly when measuring leads, is accomplished through the medium of thickness gage blocks. The work-holding adaptor can be aligned in the true vertical position and also at right angles to the table top. The fixture that carries the dial indicator and various inspection units can be moved about the table when measuring involutes, or fulcrumed to the table when inspecting circular pitch, lead, pitch diameter, and eccentricity.

For inspecting involutes, as shown in Fig. 2, a master involute gage is employed against which the involute of the gear tooth is compared. Contacting with this master involute gage, when the inspection test is being made, are angular guide bars forming the sides of two rack

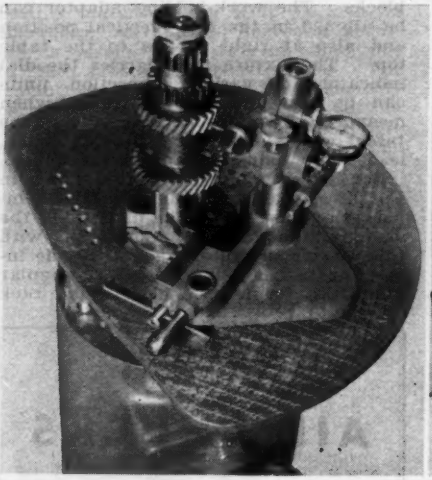


Fig. 2 (Left)—Close view showing arrangement for checking involute tooth shape by comparison with a master involute gage. Fig. 3 (Right)—Close view showing first setting for measuring leads by means of the sine bar method.

teeth, which control the position of the fixture as it is moved about on the table.

The leads of helical gears can be checked either by the use of offset or stepped master involutes, or by the so-called sine bar method. The stepped master involutes enable the involute of the tooth to be checked at two points at the same time that the lead is being inspected, and eliminates computation on the part of the operator.

For checking circular pitch, a special unit carrying a fixed stop and spring is attached to the fixture. A ball pointer replaces the involute pointer, and the gear is indexed from one tooth to the next and the variations in the position of the indicator needle are noted. For checking pitch diameter and eccentricity, master gage discs are employed for setting the cone pointer to the correct radial position. A separate cone pointer is required for each pitch and pressure angle of the gear in process.

The sine bar method of checking leads is illustrated in Fig. 3, in connection with the measuring of helical guides used on the Fellows Gear Shaper. Directly beneath the table is a hardened and accurately ground index plate and locking pawl, the plate having 36 notches which permit setting the table at intervals of 10 deg.

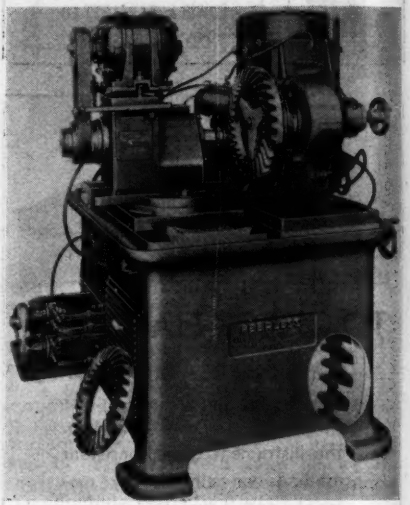
Projecting from the lower face of the table is a hardened and ground stud, and fastened to the top of the pedestal is a block against which this stud can be brought to bear. In measuring leads by the sine bar method, for angles of rotation of work that do not equal an even 10 deg., thickness gage blocks are employed between the stud and block.

In checking leads two settings are necessary: first the ball pointer is brought to the required position near the upper end of the work with the stop contacting the sine bar block. With the fixture contacting the stop on the table, the indicator needle is set at zero. The fixture is withdrawn from the work and the work-holding adaptor is elevated an amount equalling the linear distance over which the measurement is taken, this setting being accomplished with thickness gage blocks placed between the gage block projection and the top of the sleeve. The necessary angle of rotation is then obtained by indexing the plate, the fixture is advanced toward the work against the fixed stop with the ball pointer contacting the work, and the position of the indicator needle is noted. Angular errors are indicated in 0.0001 inch.

An unusual feature of the machine is its capacity for duplicating measurements to within extremely close limits. The machine will measure gears from 2 to 7 in. pitch diameter.

Peerless Bevel Gear Tooth-Rounding Machine

A Peerless Machine developed especially for rounding bevel gears as shown in the close-up in the lower right hand corner of the accompanying illustration has been announced by the City Machine & Tool Works, 1517 East Third Street, Dayton, Ohio. The machine is fast and rugged, and simplicity in set-up has been given particular attention. This machine replaces the knife-like edge of the acute angle, which has a tendency to crack or chip in hardening or in service, with a smooth, rounded shape, eliminating difficulties in hardening and assuring satisfaction in service. The machine is completely motor driven and self-contained, and has a capacity of to 18 in. outside diameter.



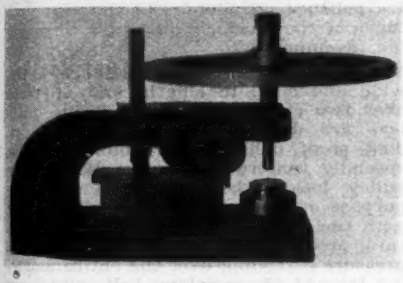
Peerless Bevel Gear Tooth-Rounding Machine.

Van Keuren Light Wave Micrometer

A bench micrometer with which readings can be taken to 0.00001 in. has been developed by The Van Keuren Company, 12 Copeland Street, Watertown, Boston, Mass. The design of the instrument includes an optical flat which produces light waves that indicate contact and pressure of the spindle.

The instrument as shown has a measuring wheel graduated in units of 0.0001 in., permitting readings estimated to 0.00001 in. A moveable index is provided for a quick setting of the zero reading. The optical flat is held in contact with the 3-in. steel flat with a spring pressure and connected with a tension rod to the arm supporting the micrometer. Thus the slightest bending of the micrometer arm is evidenced by movement of the light wave interference bands.

In operation, the micrometer is turned



Van Keuren Light Wave Micrometer.

to a zero position with a movement of one, two, three, or more bands, depending upon the measuring pressure desired. The index is set to zero and the measurement taken with the same movement of interference bands as are used for the zero reading. Any slight variations in size due to taper or out-of-roundness can also be determined by the movement of the light wave bands.

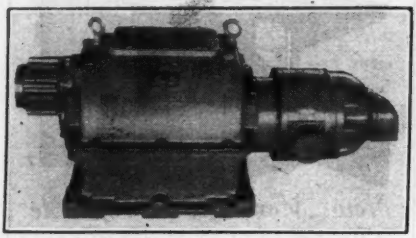
Since the micrometer is provided with two flat parallel measuring faces and can be used at any desired measuring pressure, it is suitable for a wide variety of uses such as the measuring of paper or soft materials in addition to general shop use.

Link-Belt Motorized Speed Reducer

A motorized speed reducer has recently been added to the line of enclosed speed reducing units built by Link-Belt Company, Philadelphia, Pa. The reducer here illustrated is a triple reduction unit with a speed ratio of 312.2 to 1, being one of a lot of 32 made for driving sludge collectors at New York City's new sewage treatment plant on Ward Island. The motor shaft (which extends into the reducer housing) operates at 1165 r. p. m., and the

low speed shaft at only 3.75 r. p. m.

The advantages of using a motor with extended shaft, and mounting it in this manner, are increased efficiency and compactness, reducing of floor space required, and elimination of high speed



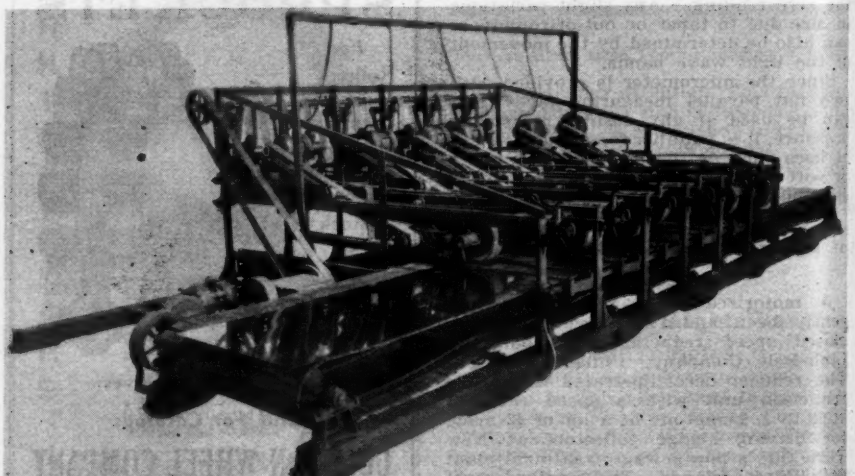
Link-Belt Motorized Speed Reducer.

motor-shaft coupling. Roller bearings and continuous-tooth herringbone gears are used. The gears run in oil, thus providing automatic lubrication of the gears and bearings. The tabulated ratings will be for continuous duty, allowing for 100 per cent momentary overloads.

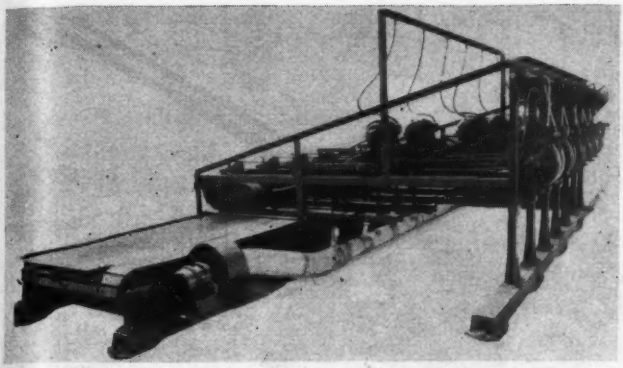
Excelsior Automatic Stainless Steel Polishing Machine No. 28

The Excelsior Tool Machine Co., East St. Louis, Ill., has placed on the market a machine that has been especially designed for polishing large stainless steel sheets, and is known as the "Excelsior No. 28 Automatic Sheet Polishing Machine." The machine is of the "straight-line" type, and will polish any width of sheet up to 60 in. or longer to a commercial finish in one continuous pass under a multiple of polishing belts. The process of polishing on this machine is continuous. The sheets are placed end to end on the endless belt conveyor, passing under a multiple of roughing and finishing belts at a constant speed, and are polished completely, to the extreme edges of the sheets, in one pass through the machine.

The endless polishing belts are 7 in. wide and 8 ft. in length, and operate over two end pulleys. The inside pulleys are driven direct from 10 h. p. dust proof ball bearing motors with a specially constructed intermediate idler pulley located between them for the purpose of contacting the polishing belt with the sheet. This self-adjusting feature, producing a uniform and constant pressure extending over the entire working face of the polishing belt, plays an important part in the success of the machine. The pressure on the polishing belts is regulated by weights provided for this purpose. The loose pulley spindle is eccentrically mounted with a tightening device to maintain the proper belt tension, thereby eliminating slippage



Excelsior Automatic Stainless Steel Polishing Machine No. 28, with a partially polished sheet passing under the six abrasive belts.



Rear View of Machine, showing Dust Collector Fan Suction Pipe.

of the polishing belts. The conveyor is adjustable with a speed ratio of 2 : 1, corresponding to 60 to 120 lineal ft. per hr. The six-belt machine illustrated requires floor space of 38 x 18 ft., and weighs approximately 32,000 pounds.

Assuming that the sheets are of good quality with a minimum of rolling defects, a 16-spindle machine will polish and buff 300 sq. ft. of material per hr. in one pass, or the same amount can be buffed and polished at two passes through an 8-spindle machine. Any of the polishing belts can be removed (when dull) and replaced in two minutes without interfering with the production or continuous operation of the rest of the spindles. The belts are easily reset by the use of a specially-designed fixture for that purpose.

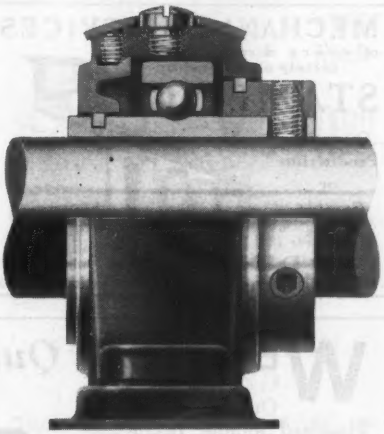
The spindles are three feet apart, which prevents over-heating or buckling of the sheets. The suction fan removes the dust that is generated and also assists materially in cooling the sheets. All moveable parts are, as far as is practicable, provided with dust proof ball bearing housings. Any number of spindles from four to sixteen can be furnished, by means of which any desired finish can be obtained.

Dodge Type DH-1 Self-Aligning Pillow Block

An anti-friction bearing in the design of which are incorporated the characteristics demanded by designers of machinery has been placed on the market by The Dodge Manufacturing Co., Mishawaka, Ind. This bearing, which is known as the Dodge Type DH-1 Pillow Block, is provided with single row deep groove Hoover ball bearings, the balls of which are high carbon chrome steel, uniformly hardened and held accurate within 0.000025 in. Thus uniform load distribution and quiet operation are assured.

The housing is of heavy gage steel, formed to extreme rigidity, and is of two-piece construction. This split feature is of great importance as it facilitates installation or removal of the bearing. The use of steel instead of cast iron for the housing also permits smaller overall dimensions, thus making the bearing applicable in places where larger overall dimensions would bar it from use.

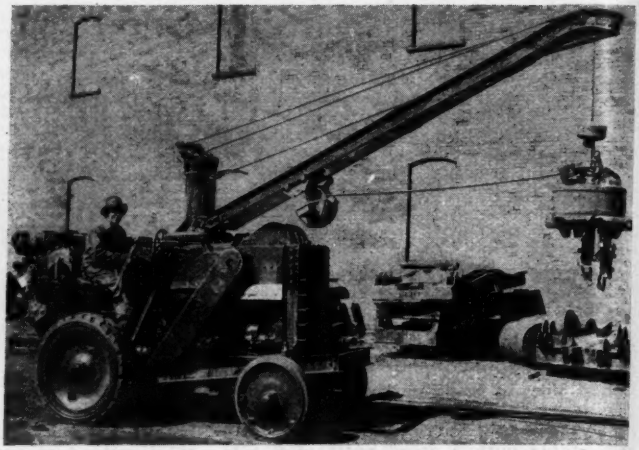
The bearing is fully self-aligning, which eliminates the necessity of having supporting surfaces absolutely in line and, as a consequence, the frame of the machine on which the bearing is mounted does not require the rigidity necessary to completely insure against misalignment. The self-aligning feature is obtained by making the outside of the inner housing and the inside of the outer housing spherical, providing a true ball and socket action.



Dodge Type DH-1 Self-Aligning Pillow Block.

Both radial and thrust load capacity are provided. The pillow block can be furnished in either expansion or non-expansion type. The expansion feature provides for changes due to temperature or bearing position due to side warping or springing of the machine frame. The bearing is a completely assembled, factory-adjusted unit, hermetically sealed against loss of lubricant or admission of dirt.

The Dodge Type DH-1 bearing is secured to the shaft by setscrews in the driving collar, which is fitted over one end of the extended inner race of the ball bearing, providing a three-point grip on the shaft and insuring a secure and permanent fastening.



"Loadmaster" Equipped with 20-In. Electro-Magnet.

Loadmaster Equipped With 20-In. Electro Magnet

The Loadmaster, manufactured by Bucyrus-Erie Company, South Milwaukee, Wisconsin, and mounted on either wheels or crawlers, may now be obtained equipped with a 20-in. Ohio magnet. This magnet equipment makes the machine a very useful tool for handling scrap iron and small castings which ordinarily require considerable time for hooking. Since the Loadmaster requires no more space for operation than a small automobile, since it has a full-revolving boom and since it can be used as a tractor, as a crane, or can lift and travel with its load, it fills a long felt want for industrial units whose material handling problem has not warranted the purchase of a larger ma-

chine. Power is supplied to the magnet by a 2 K.W. Kohler electric plant, mounted on the truck frame of the crane.

Landis Catalog of Threading Machines and Automatic Forming and Threading Machines

The Landis Machine Co., Waynesboro, Penna., has put out a catalog consisting of a series of bulletins in which are described and illustrated the new "Landmaco" Threading Machine, Landis Standard Threading Machines, and Landis Automatic Forming and Threading Machines. Complete details and specifications are included, and the illustrations include close views of the more important parts of the machines, showing the design. Copies gratis upon application.

Atlas Bench Lathe Operating Manual

The Atlas Press Co., Kalamazoo, Michigan, has issued a 16-page booklet that not only contains a complete description, illustration, and specifications of the "Atlas" 9-in. bench lathe, but also contains complete operating instructions.

The subjects discussed are: Locating Centers; Centering Work in a Chuck; Cutting Tool Bits; Sharpening Tools; Angle of Tool to Work; Cutting Speeds; Belt Tension; Facing; Turning Long Work; Boring, Cutting Off; Taper Turning; Knurling; Thread Cutting; Universal Chuck; Compound Rest; Carriage Stop; Wood Turning; Conclusion.

The different tools and attachments that can be used with the Atlas Lathe are shown, and a decimal equivalent table and table of "Don'ts for Machinists" are included. Copies free upon request.

Greenfield Tap & Die Catalog No. 32

The Greenfield Tap & Die Corporation, Greenfield, Mass., is now distributing copies of Catalog No. 32, which describes and illustrates the complete line of taps, dies, screw plates, twist drills, reamers, gages, pipe tools, and other tools made by this company. Among the new items that are shown in this catalog are the "Tru-Lede" taps, "Lightning" twist drills, and a line of reamers of improved design, among

which are expansion chucking reamers, spiral fluted shell reamers, and a number of special automotive reamers.

"Little Giant" screw extractors are listed for the first time, as are also the "O K" ratchet stock for square pipe dies, a line of Saunders-type pipe cutters with thin-edge chrome vanadium cadmium plated cutter wheels, a ratchet stock with "Slip-On" rethreading dies, and a ratchet burring reamer.

The text includes a number of useful tables and considerable new data on the uses and applications of small tools.

Users of Stampings Get Thermometer

The Detroit Stamping Company, 3451 West Fort St., Detroit, Michigan, is now sending out a "Cheer Up" thermometer in response to each request that is accompanied by a request for quotations on specified parts. The thermometer is attached to a sample board which also bears specimens of some of the various kinds of materials now used in making stampings, the specimens including washers of brass, bronze, copper, prefinished metal, soft lead, German silver, No. 60 mesh brass wire screen, fibre, and cadmium-plated pickled steel.

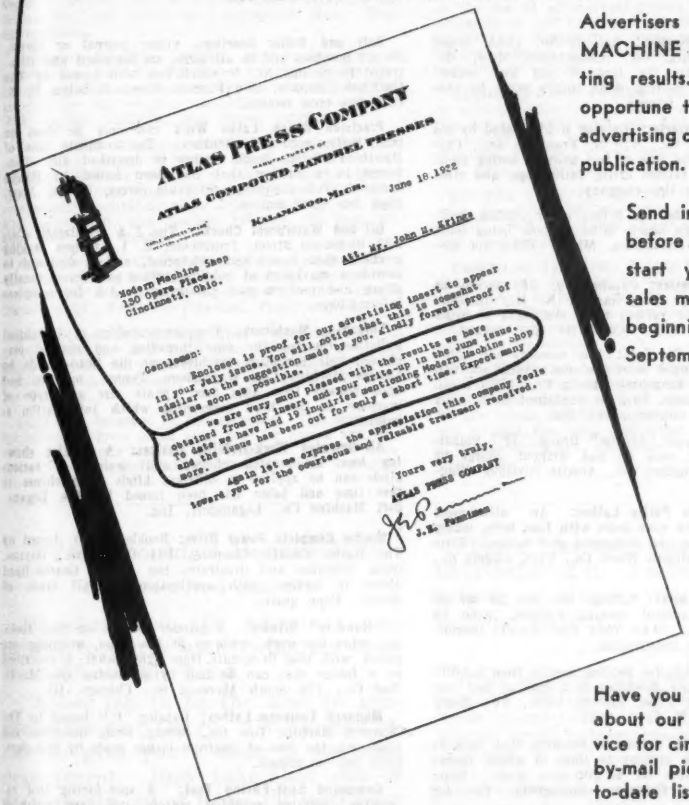
Arbor spacers of brass and cadmium-plated cold rolled steel are also included, together with a "face" stamping of sheet aluminum that has been processed to produce a corrosion-proof oxidite hardened surface, increasing the strength of the part 75 per cent, and colored with an aniline dye. The thermometer scale is of prefinished satin chromoloid, the use of which eliminates a large part of the work that would formerly have been required to produce a piece of work of the same quality and thus points the way to definite savings. Users of stampings will find the thermometer useful in more ways than one.

Commercial Centerless Grinding Available

The Porter Machine Company, 3120 Forrer Ave., Oakley, Cincinnati, Ohio, is now engaging in the commercial grinding of parts by the centerless method, the service consisting of straight cylindrical grinding, shoulder grinding, or the grinding of profile surfaces, of any material.

The company is also specializing in the production of small screw machine parts, which can be hardened, when desired, and finished by centerless grinding.

"19 Inquiries from one announcement -- expect many more"



ATLAS PRESS COMPANY

ATLAS COMPOUND MANDREL PRESSES

KALAMAZOO, MICH. June 10,1932

Att. Mr. John H. Eriner

Modern Machine Shop
120 Opera Place.
Cincinnati, Ohio.

Gentlemen:

Enclosed is proof for our advertising insert to appear in your July issue. You will notice that this is somewhat similar to the suggestion made by you. Kindly forward proof of this as soon as possible.

We are very much pleased with the results we have obtained from our insert and your write-up in the June issue. To date we have had 19 inquiries mentioning Modern Machine Shop and the issue has been out for only a short time. Expect many more.

Again let me express the appreciation this company feels toward you for the courteous and valuable treatment received.

Yours very truly,
ATLAS PRESS COMPANY
J. E. Fenniman

Advertisers in MODERN MACHINE SHOP are getting results. Now is the opportune time to start an advertising campaign in this publication.

Send in copy material before August 24th and start your company's sales messages working beginning with the September issue.

Have you full information about our addressing service for circulating direct-by-mail pieces to our up-to-date lists of potential buyers? Write for details.

MODERN Machine Shop

128 OPERA PLACE CINCINNATI, OHIO

For Your Catalog Library

Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

Chucks—Key and Keyless: Bulletin No. 120A, issued by T. R. Almond Mfg. Co., Ashburnham, Mass., describes and illustrates the line of key and keyless geared nut and ball bearing drill chucks made by this firm. Copy free upon request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

"Atlas" Bench Lathe: A 9-in., screw cutting, self-contained, motor-driven bench lathe is now being built by Atlas Press Co., Kalamazoo, Mich. Write for circular.

Greenerd Arbor Presses: Catalog No. 36, issued by the Edwin E. Bartlett Co., Nashua, N. H., describes and illustrates all the various types and sizes of arbor presses made by this firm. Copy free upon request.

Drop Forged Steel Die Sets: The economy and other advantages of drop forged steel die sets, which are now being made by E. A. Baumbach Manfg. Co., 1806 South Kilbourn Avenue, Chicago, Ill., are explained in a folder that can be had by addressing this firm.

Abrasives: Samples of "Aloxite" Brand "TP" Polishing Grains for trial may be had without charge by addressing the Carborundum Co., Aloxite Division, Niagara Falls, N. Y.

Motorize Your Cone Pulley Lathes: An attachment that can be applied to your lathe with four bolts makes it possible to motorize and modernize your lathes. Write for information to Cullman Wheel Co., 1336 Algeld St., Chicago, Ill.

Steel Spacing Washers: Milling jobs can be set up quicker by using standard spacing washers, made by Detroit Stamping Co., 3445 West Fort Street, Detroit, Michigan. Write for information.

"Speed" Spot Welders for welding metals from 0.0005 in. to 5/8 in. thick are described in a catalog that can be had by addressing Eisler Electric Corp., 761 South 13th Street, Newark, N. J.

The Red Liner is an automatic machine that inspects gears under conditions similar to those of actual operation, and charts errors on a 200-to-1 scale. Write Fellows Gear Shaper Company, Springfield, Vt., for booklet.

Performance Data On Swiss Jig Borers: This 36-page pamphlet shows various types of jobs from a power shovel turntable jig to a television disc, drilled and bored on Societe Genevoise High Speed Precision Borers, giving data as to size of holes, accuracy and time savings. Free upon request to The R. Y. Ferner Co., 1008 K Street, N. W., Washington, D. C.

Stampings of any kind or size can be obtained from Gerding Brothers, 5 East Third Street, Cincinnati, Ohio. Write for particulars.

Engraving and Die Sinking Time can be reduced to minimum by the use of a Gorton Universal Die Sinking and Engraving machine, made by George Gorton Machine Co., 1101 13th Street, Racine, Wis. Bulletin free upon request.

Ball and Roller Bearings, either journal or thrust, for all purposes and in all sizes, are described and illustrated in catalog No. 9 which has been issued by The Gwilliam Company, 360 Furman Street, Brooklyn, N. Y. Copy free upon request.

Precision Bench Lathe Work can only be done on finely-built, accurate machines. The complete line of Hjorth Precision Bench Lathes is described and illustrated in a catalog that has been issued by Hjorth Lathe & Tool Company, 60 State Street, Boston, Mass. Copy free upon request.

Oil and Waterproof Chucks: The J & H Electric Co., 202 Richmond Street, Providence, R. I., is now making a chuck that is oil and waterproof, and is designed to provide a maximum of holding surface with exceptionally strong and uniform pull throughout. Ask for complete information.

Threading Machinery: Complete catalogs of individual bulletins covering the pipe threading and cutting machines, bolt threading machines, or die heads made by Landis Machine Co., Waynesboro, Penna., may be had upon request from this firm. State size and type of machine or die head concerning which information is required.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Master Complete Power Drive: Booklet S210, issued by The Master Electric Company, 104 Davis Ave., Dayton, Ohio, describes and illustrates the Master Geared-Head Motor in service, with applications to all kinds of drives. Copy gratis.

"Hand-ee" Grinder: A grinder for use on dies, tools, and other fine work, made to fit the hand, weighing one pound, with plug to operate from light socket, is described in a folder that can be had by addressing the M. C. Tool Co., 120 South Aberdeen St., Chicago, Ill.

Monarch Toolroom Lathes: Catalog "C," issued by The Monarch Machine Tool Co., Sidney, Ohio, describes and illustrates the line of toolroom lathes made by this firm. Copy free on request.

Compound Spot-Facing Tool: A spot-facing tool retracting, serrated roughing cutters and fixed finishing cutters in the same tool will break up the scale easily and do accurate work. Write for bulletin to Mummert-Dixon Co., 120 Philadelphia St., Hanover, Penna.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

"Commercial Lapping for Close Limits and High Production" is the title of a booklet that discusses hand and machine lapping, types of lapping tools and machines, workholders for machines, preparation of laps, preparation of work for lapping and other important points. A copy may be had by addressing Norton Company, Worcester, Mass.

Die Making Machines: How dies, templates, gages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

Good Gears of all kinds—spur, spiral, bevel, worm, hypoid—in fact any kind or type of gear desired, large or small, machined to an excellent finish and the highest degree of accuracy, may be obtained from Perkins Machine & Gear Co., 151 Circuit Ave., Springfield, Mass. Write for estimates.

Centerless Grinding Service: Send a sample part or blue-print to Porter Machine Co., 3120 Forrer Ave., Cincinnati, O., for an estimate on the cost of cylindrical grinding by the centerless method or on screw machine work—turned, hardened, and ground complete.

Bench Lathe Mounting and Driving Equipment: Bulletin 120-A, issued by Rivett Lathe and Grinder Corporation, Brighton, Mass., contains complete descriptions and illustrations of modern and conventional countershaft, individual motor drive jackshaft, and speed box motor drive, also benches, cabinets, oil pans, etc. Copy free upon request.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Steel Stamps and Marking Dies: Full information as to steel stamps, steel roller dies, embossing dies, and embossing rolls made by the Schwerdtle Stamp Co., 10 Cannon Street, Bridgeport, Conn., can be had by writing this firm.

Speed and Accuracy In Straightening: The Springfield Straightening Press is an ideal tool for use in straightening any length or size of rough or finished work. Send for illustrated folder. Address The Springfield Machine Tool Co., 630 West Southern Avenue, Springfield, Ohio.

Cutting and Grinding Facts: A discussion of cutting oils and lubricants, together with descriptions and illustrations of various kinds of jobs upon which cutting oils are used, is contained in a booklet that is issued by the Sun Oil Company, 1608 Walnut Street, Philadelphia, Penna. Free upon request.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, surface grinders, tool-post grinders, and bench and floor grinders is described in Catalog No. 33, published by The United States Electrical Tool Co., 2471 West Sixth Street, Cincinnati, Ohio. Copy free.

Cut With Flame through steel up to 8 in. thick by using the Vulcan Flame Cutter. Uses city gas and oxygen. Write to Vulcan Engineering Corp., Jackson, Mich., for details.

Double-Life End Mills: Weldon Double-End Type End Mills, made with blades on each end, are described in Catalog No. 6, issued by The Weldon Tool Company, 1426 West Third Street, Cleveland, Ohio. Other small tools made by this firm are also described and illustrated in this catalog.

Shop Furniture: A catalog describing and illustrating all kinds of shop furniture, including benches, vises, steel stands, foremen's desks, chip trucks, steel racks for bar stock, steel tote boxes, and other equipment will be sent free upon application to The Western Tool & Manufacturing Co., 1620 East Pleasant Street, Springfield, Ohio.

"You Wouldn't Believe It"

(*Continued from page* 20)

He dismissed the secretary and turned to Gerry with twinkling eyes. He held out his hand.

"Allow me to be the first to congratulate you, Gerry. I'll 'phone Collins to give you a desk in the cost department. Now take that pile of data sheets out of here; I'll read your report and okay it, but I haven't time for that mess of figures!"

"Thank you, Mr. Hagland," Gerry beamed as he picked up the stack of data sheets.

"Thank yourself, young man!"

After Gerry had gone, the Big Boss gazed for a long time out of his window, as though he could see inside of his factory through the brick walls.

"Hmm," he said aloud, "I *wouldn't* have believed it. I wonder how much better, or worse, we are than the average factory."

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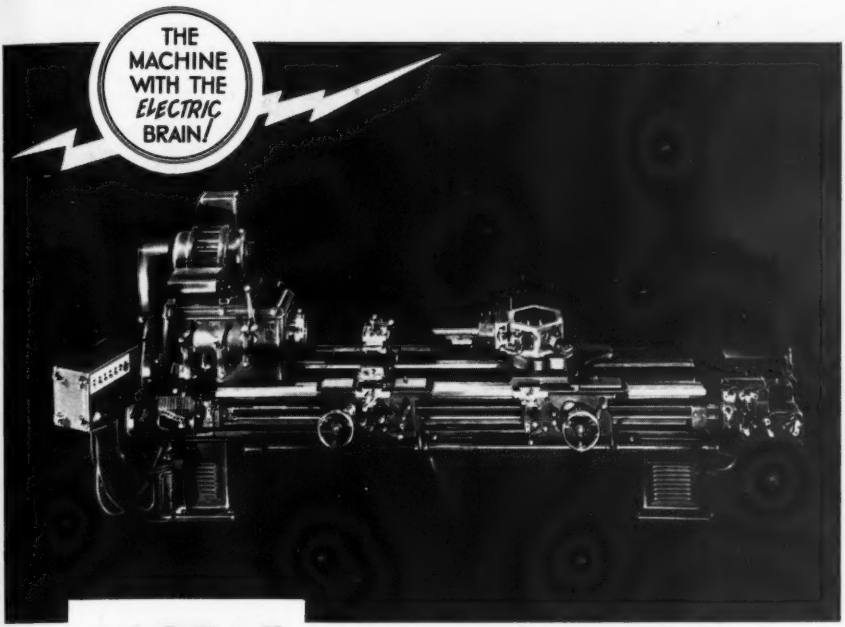

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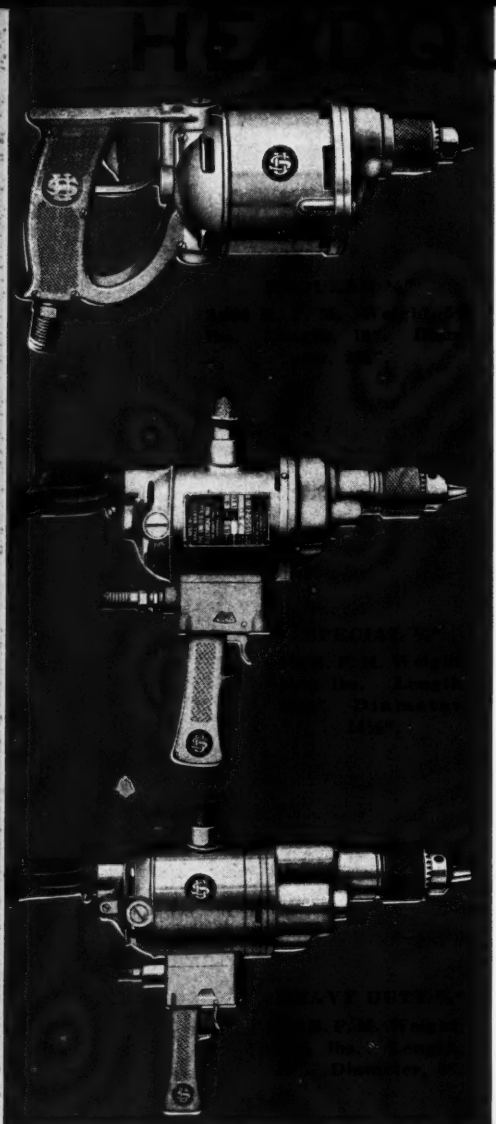

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